THE INSTITUTE OF PHYSICS

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NOTICES TO MEMBERS

Nominations to the Board

The Board's nominations to fill the vacancies which will occur on the Board on September 30 next were announced in the April *Bulletin*. In addition to the nominations for President, one Vice-President, Honorary Treasurer and Honorary Secretary, there were three nominations for vacancies as ordinary members of the Board. In accordance with the provision of Article 48 a further nomination has been received. Dr. L. R. G. Treloar has been nominated by: Mr. D. W. Saunders (*Associate*), Dr. A. J. Kennedy (*Fellow*), D H. Kolsky (*Fellow*), Dr. R. C. Faust (*Associate*), Dr. H. G. Howell (*Fellow*).

The four nominations for the three vacancies are, therefore:

M. R. Hopkins, M.Sc., Ph.D., F.Inst.P., I.C.I. Research Fellow, University College of Swansea, University of Wales.

J. M. A. Lenihan, M.Sc., Ph.D., F.Inst.P., Regional Physicist, Western Regional Hospital Board, Scotland.

J. Taylor, M.B.E., Ph.D., D.Sc., F.R.I.C., M.I.Min.E., F.Inst.P., Director, Imperial Chemical Industries Ltd.

L. R. G. Treloar, B.Sc., Ph.D., D.Sc., F.Inst.P., Senior Physicist, British Rayon Research Association, Manchester.

Ballot papers have been circulated to Fellows and Associates. Completed papers should be sent by post to the Institute's House to be received on or before May 16, or they may be handed in to the scrutineers at the Annual General Meeting that is to be held at the Institute's House at 5 p.m. on May 17. Attendance at the meeting is restricted to Fellows and Associates.

THE PRESENT AND FUTURE DEMAND FOR PHYSICISTS IN GOVERNMENT SERVICE AND INDUSTRY *

By

I — By SIR OWEN WANSBROUGH-JONES, K.B.E., C.B.
(*Chief Scientist, Ministry of Supply*)

I should like to start by thanking the Chairman for his introduction. He has done a foolhardy thing in asking me to talk to you, because I am a chemist. However, I have to occupy myself with such varied tasks nowadays that this is going to be much worse for you than for me. On one point I should like to correct the Chairman. He said that the Ministry of Supply was one of the greatest employers of scientific labour in the country. If I referred to my colleagues as "scientific labour" instead of "scientific talent" I do not know what the consequences would be !

The story about which I am going to talk goes back about ten years, to the report written by the Committee under Lord Hankey about the year 1946. That Committee attempted to prophesy what would be the future demand for scientific talent in all the different walks of science. It is clear that there was at that time a very considerable shortage, particularly of physicists, and that the Committee felt that that shortage was going to continue for a while ; but, taking into account the forecast demands of teaching, industry and Government service, and taking into account also the planned expansion of universities and technical colleges, the first Hankey Report prophesied that we should be more or less in a state of balance by 1951 or thereabouts.

The truth, of course, was very different. By 1951, partly, perhaps, owing to the Korean rearmament crisis and partly on account of industrial expansion, the demand for physicists had increased to such an extent that in 1951-52 the gap between supply and demand was probably greater even than in 1947. Personally, I regret to say that I do not see any immediate prospect of that gap between supply and demand decreasing.

I think that the reasons are fairly well understood. It is possible to give examples from all types of industry—I shall, however, leave that to Mr. Humphreys—and from Government service. Let me mention some which have recently come into the public eye, because the

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*Being the addresses and discussion at a meeting of the Education Group of the Institute held on March 9, 1955. Dr. J. Topping was in the Chair.

figures were quoted by my own Minister in the Defence debate last week, which shows why the demand for physicists has increased so much. A pre-war bomber aircraft carried rather less than 150 lb. of radio equipment ; a modern bomber carries about 9,000 lb.; all very expensive. A modern fighter aircraft contains about 6 miles of electric cable, but there were only about 2 miles in a fairly advanced type of wartime fighter. In the present-day bomber there are about 19½ miles of electric cable, compared with only 6 miles in a last-war bomber. On an average there were some 50 valves in a war-time bomber ; there are about 1,000 to-day. The electric power used in a last-war bomber was about 10 kW ; it has now risen to 90 kW. All those things, of course, require more and more effort from the industries that are based on physicists (I think that that is the best way of putting it) and also in the Government establishments which particularly employ physicists. That is a typical example of the way in which demands for physicists are rising.

Or let us take another line of country and consider the difficulties which we are now facing in the transition from the type of fighter used at the end of the war, such as the Meteor, to types such as the Hunter and the Javelin, where we are right in the middle of the speed of sound and have to face the most hideous aerodynamic problems which may ever confront us. On the other side of the speed of sound things may be easier. All this requires a great deal of work in wind tunnels—construction, measurement, analysis of results, use of computers and the like. These things make a big demand on the physical talents which are available.

Then there is the fact that the Army to-day has to re-equip itself with unconventional armaments—guided missiles and the like—in place of the more conventional ones. That was stated in the debate on the Army estimates only yesterday. In seeking more modern methods, the crux of the matter is often the shortage of physicists in one form or another.

I have spoken so far only of the Defence Services, but I am supposed to deal with Government service in general. We find the same thing elsewhere. The work that the National Physical Laboratory are now beginning to do, and are doing increasingly, on such things as servo mechanisms and controls makes a big demand for physicists. The Post Office has a big problem on its hands. It has to run very fast to keep where it is, but it is not content with that and wants to go forward. It is the same throughout nationalized industry. The coal industry has a very big task. The British Transport Commission wants to spend £1,200 million quite soon on a general modernization of the railways, with electrification, automatic train control, automatic

signalling and the like. Wherever we look, we find increasing demands for physicists and for the supporting hands to go with them.

I do not see how anyone can forecast a falling off in the demand for physicists, unless there were to be some grave economic slump which would make it apparently necessary for everybody to spend less money. Personally I would say, with some recollection of the 1930 period, that even that should not in fact cause the demand for physicists as such to fall off, because relatively speaking research and development are not so expensive as other tasks, and we cannot afford to economize on them when things are bad. Looking back, it is clear that the industries which came well out of the troubles of 1930-31 were those which did not cut back their research activities. I do not myself believe, therefore, in the light of that lesson, that if there is an economic slump we shall in fact find that the demand for good physicists decreases more than slightly. My view is, therefore, that the demand for physicists will continue to increase.

When I speak of physicists and other scientists I have also in mind certain types of engineer. In my view there are many scientifically-minded, well-trained engineers who are in fact applied physicists and come within the categories of which I am speaking. They may not have the specific Trade Union card, but in practice they do a very good job in applied physics, and I include them in what I am saying now.

I am sure that a serious shortage exists, and I submit to you that it exists at three definable levels. First of all there is the experienced man, for whom industry seems to have an insatiable demand, the man of 30 to 40, active, with plenty of working life left in him, with imagination and proved capability. You have only to look at the advertisement columns of any newspaper to see the demand for men of this type. The newspapers are full of advertisements for radio technicians and men of that type. There is an increasing drain to the U.S.A., which is calling for our better men. It so happens that in the Government service with which I am concerned it is, for technical reasons, very difficult to recruit men much above the basic recruiting grades, the scientific officer and the senior scientific officer, and to this first category of which I am speaking we can very rarely recruit, nor can we appeal because we cannot offer them salaries in relation to those commonly paid in industry. Broadly, so far as Government service is concerned, it is rather a one-way traffic in those men.

I do not take too bad a view of that. We lose some of our best men, but we do not mind losing some ; we are a good training-ground, and if we perform a national service by providing really good men for industry, that is all to the good. When, however, the

differential between the rewards in industry and the rewards in Government service, taking everything together, becomes too large, so that our losses are too great, it can be a somewhat serious matter for the nation as a whole.

Having dealt with what I will now call Category A, the trained men of between 30 and 40 years of age, I come next to the graduate with five, six or seven years of real training as a physicist behind him, Category B. It is difficult to say how long his training has been. Perhaps he has had one or two final years at a university, and two or three years doing postgraduate work in some form. He is the man that everybody wants and that my service specifically recruits. I shall say more about numbers so far as this category is concerned in a moment.

The third category, C, is the school-leaver, the boy or girl with a real interest in physics and probably a good higher certificate at Advanced level—I do not understand the technical terms now, but you know what I mean—in physics and mathematics. Recruiting that boy or girl to Government service or industry for training on the job, provided it is with a good employer who offers ample time off for further education, will provide a considerable source of very valuable recruits indeed, I believe, in the Government service, and perhaps also in industry—I do not know, but Mr. Humphreys will settle that.

Making use of those three categories, let me give you our experience in recruitment. There is nothing much that we can do about Category A, but we compete for those in Category B, and there the situation is quite interesting. I have figures here for my own Ministry for the last three years. Of the fully-trained graduates that we selected for appointment in 1952, who numbered 55, 25 came to us and 30 declined the appointment. In 1953, we selected 47 and 33 came to us. I do not think that that variation is very significant. In 1954 we selected 81, and 43 came to us. Roughly speaking, therefore, about half the men that we selected ultimately took up an appointment with us. Our demands have been increasing slightly, and we have been able to get more. Those are the fully trained men and women with first or very good second-class honours.

The lower category we call "experimental officers." They have a less good honours, or a pass degree, or a technical qualification. We find it rather easier to recruit to this class, and our totals were 40 in 1952, 42 in 1953 and 56 in 1954. There we get between 60 and 70 per cent acceptances from those we select.

We should like to get more; we need more. Of our total recruitment, something like a quarter at the moment consists of physicists, and we should like to raise that to a third. I very much doubt, however,

whether we can do so, the reason being the basic shortage. I am told that the universities to-day are not finding it possible to get more suitable young physicists for training than they have been getting over the last two or three years. I do not know whether that is true or not ; I have no means of finding out, but many people say so and perhaps someone here will tell me. It may well be so ; and, if that is the case, it looks as though we have not very much room for manoeuvre in increasing the supply.

There is, of course, no way of increasing the number of fully experienced people, those in what I have called Category A. So far as the second category is concerned, the good graduates, it may be that their numbers can be slightly increased. I do not think that there is much more that can be done there, but I should like to hear your views. With regard to the third category, the school leaver or the less highly trained person than those in Category B, I submit that there is more possibility. They should be very useful, because they make three positive contributions. In the first place, they make a positive contribution of their own, because they do work which helps. Secondly, by having enough of them it is possible to relieve the load on the graduates in Category B and produce a better utilization of our better people. Finally, they will provide some flow into Category B.

Their management is difficult, because if they are not well managed and given adequate pay, prospects of promotion and so on, they degenerate into a depressed class, and that is bad for everybody. On the other hand, we can accept for them a rather narrower training than is appropriate for the fully-trained graduate type, the sort of training which may be given at one of our own apprentice schools. I consider that the product of the electronic apprentice school at the Radar Research Establishment is an extremely good type to have, although essentially narrower, in my view, than a fully trained graduate should be.

I do not know whether it is true or not, but I suspect, from what I have seen of graduates who get third class honours, or who just do not, that there is quite a number of them who, if they had been trained more narrowly and more practically and had been a little less ambitious, would be a better product and, I believe, happier people. It is quite likely that there is a number who should have taken sandwich courses at technical colleges, where I know that they are extremely well trained, rather than have attempted the harder full honours course at a university. That may be a provocative statement, and, if so, I shall be glad to know what the true answer is.

I should like to end with a few words about the types of scientist that are required. Naturally enough, I deprecate too great a division

into specialist scientific schools. I think that it is a pity—I am not going to put it more strongly than that—that things have developed in such a way that the physicist has to be labelled "nuclear" or "electronic" or "aerodynamic" or "optical" or something else, as the case may be, at the graduate stage, but that is becoming more and more inevitable. I accept the fact that the highly trained man in Category A will certainly be a specialist; he ought to be by that time. I agree also that for Category C we can accept a narrower training. It is becoming very obvious, however, in my own parish that these rather sharp distinctions and divisions into the four or five major fields which I have mentioned are a pity.

I accept the fact that as the bounds of knowledge extend, so the content of physics which has to be taught to honours standard will in fact increase, and therefore I accept the fact that some degree of specialization is probably necessary, but I hope that it will not be done much more than it is to-day. It seems to us that many young men now think that their future as physicists lies mainly or primarily either in the nuclear or in the electronics field. That may be true in principle, because the expansion in those two fields is obviously going to be formidable in the foreseeable future. All these young people, therefore, will get good jobs, and I cannot find it in my heart to try to persuade those in charge of the young that they are damaging their prospects by training them primarily as nuclear or electronic physicists; but nationally they must all be supported all the time by the more general type of scientist—the physicists who are capable of working on some optical problems and are interested in them, who are working on the properties of matter or who can be trained as physical metallurgists, people who really do understand the general properties of matter, and so on.

There is another class which is very important but which is now getting left out, the men who will work at such very difficult things as, say, advanced applied dynamics. The weaknesses in some of those supporting fields are becoming increasingly serious. The problems of supersonic flight and really high speeds are problems of aerodynamics structures, aero-elasticity and materials; they are basically problems of physics, and very difficult problems of physics. It is in those fields that we have the greatest difficulty in recruiting good people. In the electronics field we have the greatest difficulty in recruiting enough people, but in point of fact we do find a lot of good ones.

I am not going to risk making any forecasts, either by numbers or by types, of what future demands will be, because all experience has shown that everybody who has tried to make such a forecast has been proved in the event to be wrong, and I do not want to add yet

another false prophecy ; yet if we generalize, and bear in mind also the grave shortage of science teachers in schools, with which you are all so desperately concerned, it is evident that much must be done to increase the total supply, if it can be increased. I am not going to address myself at all to the problem of science teachers, except to say that the Government service for which I am (unofficially) speaking is extremely well aware of that problem and realizes that it may mean that there will not be scientists of any type coming forward in anything like adequate numbers.

That brings us to the problem of how to interest the children even more than at present, and it also brings me to a hobby-horse of my own, the possibility of teaching a little faster. Is it not really true that there is still a good deal left in the general teaching syllabus, in the requirements for examinations at all levels up to graduate level, which could be trimmed a little to make a little more room for the modern advances and to make it a little easier for boys and girls of 16 or 17 who have suddenly decided that they would, after all, like to do science, to get to grips rather more quickly with the subject than they do at present ?

It is outside my terms of reference, and someone may tell me that I am talking as only a chemist would talk, and that may be true ; but the more I reflect on the subject the more certain I am that it is terribly important to get more physicists of all grades, and that perhaps the most promising line to follow is this third category that I have mentioned, and that to get more people in that third category something in the nature of a new look in teaching would possibly be appropriate.

II — By O. W. HUMPHREYS, B.Sc., F.Inst.P.

(*Director, Research Laboratories, The General Electric Co. Ltd.*)

The problem we are discussing this evening is very complex. I am not going to spend time analysing the demand ; it is sufficient for my purpose to note that it clearly exceeds supply.

It is true that the forecasts made by the Hankey Committee and others have proved to be in error. I do not think that we can blame those who made them ; fresh demands have arisen of which they had no knowledge at the time. Our real trouble, of course, is that there are too many of us in the market for the limited supply of physicists. We have industry, we have the Government (particularly defence), we have atomic energy now coming into the picture, and we have, of course, the temporary withdrawal of people to do their military service. If the situation becomes really desperate—frankly, I do not think it is at the moment, although it is certainly difficult—we may have to look

at the different demands and try to assign relative priorities ; and then we may be in real trouble, for it is so difficult to find a common basis on which priorities can be assessed. In time of war it is easy, because we are all single-minded ; but I am talking not about a time of war, but about a difficult time of peace.

It is occasionally suggested that the needs of defence are paramount, and that to meet them people must, if necessary, be transferred from work of less importance in industry. That, of course, shows a complete lack of understanding of the situation as it exists in time of peace ; the very heavy expense which this country is now incurring in the field of defence and in the field of atomic energy (though the justifications are quite different) can be met only if the country is prosperous. The country can only be prosperous if industry is prosperous, and in particular, in this post-war world, if our export position is sound.

Many sections of industry have already gone a very long way in diverting effort from civil work to defence work ; and there is no doubt that civil developments have fallen behind in consequence. Internally, that may not be of vital importance so long as we all play our part ; but externally we have reached a stage at which any further reduction in the rate of civil development will seriously jeopardize our competitive position in overseas markets.

It is too early to say much about atomic energy, but it is undoubtedly making very big inroads into the limited supply of scientists and technologists. In that field, as in some others, the rate at which we can afford to progress is one of the matters which we shall have from time to time to consider.

The statistics show that the number of science students graduating each year is approximately twice what it was before the war ; we have to ask ourselves whether this figure can be further increased. Wishful thinking will not help ; the question is, are we getting all the physicists we could or are we not ? Analysing the situation there are, I think, three possible sources of loss which merit consideration. The first is the failure of potential physicists to reach the grammar schools owing to wrong posting. There seems to be little evidence that that is a serious source of loss.

The second is failure to reach the university, and there the ation is more serious, because it is one of the anomalies of our times that, when entry to the universities has officially been made so much easier, there is one section of the community for which it has been made very difficult. I refer, of course, to the sons of those parents who are the victims of

the new means test. I cannot believe that the appropriate Government departments are not alive to that anomaly ; we can only hope that they will act quickly.

In the meantime, industry (and Government research establishments) have to fill the gap. Fortunately we can ; but we have to recognize that there is a job for us to do. We must have our plans prepared so that we can get our hands on these people quickly—they are very glad to come to us, but if we are slow could well be lost for ever—and provide for them the training which is denied to them at the university. I do not suggest for a moment that they would not do better to go to the university if they could, but if we tackle the problem in the proper spirit we can provide a worth while substitute for the training they would receive there.

In the engineering world it is considered that even the full-time university graduate needs two years of postgraduate training before he is posted to a job. Yet some of us are willing to try to train physicists by taking boys straight from school, putting them at once on to a normal job of work, and leaving them at the same time to work for a degree. That is a little tough, though our Institute contains outstanding proof that it can, at times, produce good results. It is time, I think, for us, to reconsider the question of the training of these young men and women in order to ensure that the course offered is the best possible substitute for that which would be provided in the University.

The third source of loss—the deflection of potential scientists to non-scientific subjects—undoubtedly demands careful thought. It is primarily a reflection of the poor standard of scientific teaching in many schools to-day. A boy's interest in a subject is inevitably influenced by the way in which it is taught and his assessment of its potentialities as a career by the people he associates with it. If he likes those who teach him arts better than those who teach him science he tends, subconsciously, to become prejudiced against science as a career.

I have a very real admiration for those now teaching science in our schools : they are doing a very difficult job, frequently with qiute inadequate recognition. I believe, however, that raising the level of teaching in the schools would do a great deal to increase the supply of scientists.

The difficulty has undoubtedly been aggravated by the growing tendency of the universities—by increasing their entry standards—to call on the schools to teach science to a more advanced level. Even if there were adequate teaching resources in the schools, this tendency must lead to an over-concentration on cramming during the last two years of the boy's school life and to a neglect of his more personal

education. Headmasters could undoubtedly help by encouraging more boys and girls to take up science as a career ; they would probably do so were it not that by so doing they would, in present circumstances, be making rods for their own backs. An enquiry recently carried out at Bristol University revealed that many young teachers of arts subjects would be prepared, if suitable training courses could be provided for them, to switch to teaching science. Could there be clearer evidence that if those people had been subjected to the right influence a few years earlier they would have come up the scientific ladder ?

Once the teaching profession is made more attractive, employers, in particular large employers of scientific workers, should encourage suitable members of their staffs to switch to teaching. Many of our industrial and Government Laboratories have on their staffs people who would not only be very happy in teaching but who would probably make better teachers than research scientists. They would contribute more to the common weal by bringing on other people to be research workers than by playing that role themselves.

I do not believe, however, that all these things will very greatly increase the supply of physicists. They are all worth doing, because we must do everything we can ; but we must also give very careful thought to the use we make of the physicists that we have and in particular to the effectiveness of the steps we take to develop properly their latent abilities. I am sure that we do not do all that we might in this direction.

Universities are sometimes criticized for a tendency to label people much too early as nuclear physicists, electronic physicists or specialists of some other kind and to concentrate on too narrow a training. The criticism may or may not be justified ; it would certainly be equally wrong not to label them and to try to make them expert in all these fields. With the vast expansion of knowledge we are undoubtedly reaching a time when it must be accepted that in a first degree it is not possible to do more than give a good, sound grounding in physics ; leaving the acquiring of a deeper understanding of specialized fields to the postgraduate period.

I am also sure that physicists would benefit from more concentration in the universities on teaching them to express themselves. Far too often we find that the new graduates, of 25 or 26 years of age, though very knowledgeable, cannot write a report, and indeed appear to have but little experience in the use of the English language.

What we value in new graduates is a good basic training, ability to think and reason logically, and to express themselves clearly, and some evidence that the last few years of their lives have not been entirely spent on academic pursuits.

The new graduate needs a good deal of postgraduate training to turn him into a sound research worker and all too often our urgent need for someone to do a job of work deprives him of this training. That may be inevitable at the moment, but we should be giving careful thought to our plans for training when the situation eases. We should, for example, carefully weigh the relative merits, as a means of training, of two to three years post graduate research at the university and the alternatives which industry itself might offer. We should carefully weigh the relative advantages of putting a man for two or three years on to research in some field into which he can delve very deeply and, on the other hand, giving him a variety of shorter tasks which will give him a broader insight into the sort of problems with which he will be dealing later on. I do not profess to know the answers to any of these questions—certainly the same treatment will not suit the needs of all individuals—but the problems are very real and a study of them would undoubtedly pay good dividends.

I should also like to ask whether many physicists would not benefit during their early post-university years by having a year or so in a factory. Not all physicists spend their lives doing pure research—many will find themselves eventually working on development problems and they will greatly benefit from having seen something of the way in which the products which they develop are made.

I would also say a word to the group leaders to whom the new graduates are directly responsible. By the time that a man has been working for a year or two in a particular field, he will have become expert and valuable. If kept working in that field, he may have another eight or ten years of extremely useful service ahead of him, progressing satisfactorily from both his own point of view and that of his group leader. At the end of that time—say at the age of 35 or thereabout—it may well be found that the job he is on has developed to its limit and that it could, indeed, be adequately performed by a younger man. You look around for another opening for this specialist and find that since he left the university his experience has been so narrow that he is very difficult indeed to place. Group leaders should determine that, whatever the cost to the smooth running of their departments, they will not allow a man to stay on his first job for more than two years, unless they can see that that job is going continually to broaden out and offer opportunity for advancement for many years to come.

Another thing which is very important, but which is often overlooked in a research laboratory, is that the young scientist needs to be trained to take responsibility. He is going to be a vastly better man when he is 40 if he has been trained to take responsibility at the age of 26 or 27. You cannot learn to take responsibility without making

mistakes, and obviously the best time to learn is when the level of responsibility is not very great and the effect of mistakes will not be very serious. I am increasingly impressed with the difficulty of finding people who are really qualified to take senior positions. We undoubtedly have good material and there is no doubt that it is our own fault if we misuse it.

Having fully developed the latent abilities of the physicist, it remains to ensure that he is properly used. It used to be thought to be healthy to let a physicist prepare his own apparatus and assemble it and do all the chores associated with his research. It may be healthy, and for a short period it may be desirable, but we shall only get our research done, with the limited number of physicists available, if we use our resources economically, and we shall undoubtedly obtain a much greater yield from our physicists by providing properly trained technicians to support them; I am not thinking of the failed B.Sc.'s, but of men who have done well in a course specially designed for them, as Laboratory Technicians. I believe that a man whose intellectual calibre is not of the first order can find a very satisfying career in the supporting ranks in a research laboratory ; he can undoubtedly make a very big contribution to the work of his team.

Finally, we have to exercise great wisdom in determining what work we shall do. We have to obtain all the physicists we can, we have to train them well and to support them properly, and then we have to see that they do not waste their time doing work which careful thought would have shown to be unnecessary. Here I should like to emphasize, as I have done on other occasions, the very great difference between ourselves and our friends in America. In America, where, until quite recently at least, there has been a fairly ample supply of scientists and no financial stringency—the two things are slightly associated—a laboratory, given a problem to tackle, has tended to study it carefully, to devise, say, half-a-dozen experimental approaches and then to put separate teams on to each of them. Given the effort, such approaches can scarcely fail to yield good results. In this country, however, we are usually fortunate if we can find the effort to follow up one of the approaches, and we have to do much hard thinking to ensure that we make the best selection. We are rather in the position of the General in the field who has continually to reach decisions on the basis of inadequate information. He has to develop sound judgement and learn to trust it.

To sum up : there is undoubtedly a real problem, but do not exaggerate it. I believe that if we increased our annual output of physicists by 5%, it would go a very long way, in the course of a few years, towards solving our problem. The problem will only be solved

by full co-operation between Government, schools, universities and industry. Each has a contribution to make.

Our objectives must be firstly to persuade those with the necessary capabilities to seek careers in science ; secondly, to see that they receive the finest training which it is possible to give them ; thirdly, to provide sufficient, properly trained, supporting staff ; and fourthly, to endeavour to be wise in the selection of our programmes.

DISCUSSION

MR. D. F. PERRENS (*Eastbourne College*) said that those concerned with the teaching of physics at Advanced level in public and grammar schools were faced with the problem of what might be called "headmaster's prejudice," in that a scientist in the school was still not considered, generally speaking, as having an educated view, whereas a teacher of modern languages was. Those who were doing their best to interest boys of 16 to 18 in science were not finding much encouragement. He suggested that companies might consider approaching the Public Schools Appointments Bureau and arranging for more visits to the schools, especially when it was possible to reach not only the boys but their parents as well. The prejudice of parents was almost as strong as that of headmasters.

DR. H. V. WALTERS (*Durham University Appointments Board*) wished that he could be as optimistic about the situation as both the speakers. Mr. Humphreys did not appear to regard it as desperate, but Dr. Walters believed that it was. Students commonly had as many as a dozen preliminary interviews ; some hundred and fifty employers had visited Durham University already this year. Large numbers of medium and smaller sized concerns could scarcely attract a candidate, let alone recruit him. The situation was growing rapidly more acute.

A major factor in the success of Government Departments in recruitment was the virtual certainty of indefinite National Service deferment. This applied also to industries working on defence contracts and left others with the rejects to recruit two years later. Many industries were only just realising that their difficulties in staffing new projects were not temporary and attributable to a lean period or bad luck in recruitment. Others had drawn up new plans for development and expansion that could never possibly all be adequately manned.

SIR OWEN WANSBROUGH-JONES pointed out that he had refrained from making any estimate of what the deficiency was ; he did not agree with Mr. Humphreys that it was a small deficiency. It was at least a 50 per cent deficiency, and it might be more. He would

like to have 30 to 40 per cent more than he could get. He was very well aware that the Ministry were in a favoured position vis-a-vis the smaller firms and, in particular, schools wanting science teachers. He knew what the published number of vacancies for science teachers was, but he also knew that the number ought to be much larger, because some people were teaching at present who should not be doing so and some schools had had to give up. He had therefore no optimism or equanimity whatever.

On the very real difficulty of National Service deferment he was not in a position to make a statement, because it was under the control of the Ministry of Labour and National Service. The numbers recruited by the Ministry of Supply however, were small ; in 1954 only 40 physicists had been recruited directly, which was not a large number compared with that taken by Industrial firms. The Ministry of Supply had no policy of trying to take advantage of their position in regard to National Service.

MR. HUMPHREYS said that when he spoke of the problem not being desperate, he did not intend to suggest that a 5 per cent increase of physicists would immediately solve the present problem, but he did feel that a maintained increase of 5 or 10 per cent per annum would make a major difference to the problem within the next five years.

DR. E. ROBINSON (*English Electric Company, Stafford*) agreed with the emphasis placed on the present shortage and believed that it had led to the very invidious intensive advertising campaign in the daily press. In order to get good science graduates a firm had to spend between £50 and £100 per head on advertisements. The shortage of science graduates had also led to the setting up of training schemes at graduate and technical level in most of the big companies.

He would like to know why the Ministry of Supply in particular invariably included in their advertisements the words " first or second class honours degree." In view of the extreme shortage, it was necessary to have the best distribution of the best physicists available. Of the recruits referred to by the various speakers, graduates engaged at the age of 25 to 28, it would be interesting to know how many had first or second class honours. He believed that the intake should be wide enough to give scope for those with third class and pass degrees, because they often proved to be good leaders and useful people on the technological side in industry.

SIR OWEN WANSBROUGH-JONES replied that the Civil Service Commission had laid it down that unless there were exceptional reasons a man would not be admitted directly into the Scientific Officer class, the highest class, unless he had a first or second class degree. At the

same time, however, they recruited for the Experimental Officer class men with third class and pass degrees, and there were avenues for transfer from one class to the other. It was difficult to put a Scientific Officer down into the Experimental grade, but numbers of the better people were transferred from the Experimental Officer to the Scientific Officer grade when they had proved on the job that they were worth it. They recognized that examinations were a good initial sorting machinery but by no means gave the final answer. It was easier in industry than in the Civil Service to transfer downwards. He believed that the correlation between a general ability and special aptitude was higher than Dr. Robinson suggested. Their best managers and the people who ran groups well and later obtained positions of managerial quality came more often from those with first and second class honours than from those with third class and pass degrees.

MR. F. J. CROWE (*Norwood Technical College*) referred to the standard of teaching of physics in girls' schools, which was appallingly low in general. If there was such shortage of physicists, one way of rectifying the position would be to encourage the better teaching of women.

MRS. AREGGER (*Hilger & Watts Ltd.*) said that in girls' schools bright girls were encouraged to learn modern languages and classics and the teaching in science was inadequate. A university would not except a woman entrant for science unless she was very good indeed, because there was a prejudice in favour of men. The general tendency seemed to be that girls should not be encouraged to do physics.

SIR OWEN WANSBROUGH-JONES remarked that the chances of a woman in his own service were as good as those of a man on entry, and the same might largely be said of the chance of a career. It was of interest that the leading apprentice to pass at the R.A.E. apprentice school was a young lady.

MR. H. W. HAMBLING (*Borough Road College, Isleworth*) believed that the "pipe-line" of physicists from the schools through the universities and into employment was very nearly full. The report of the Ministry of Education showed that in 1953 more candidates entered for the General Certificate of Edueation examination in physics at Advanced level than for any other subject, including the arts subjects. The number of girls taking physics was 2,500, compared with 4,500 taking French, so that physics was not neglected in the sixth forms of girls' schools.

Figures for London University showed that 65 per cent of the full-time students in the session 1953–54 were in the faculties of science, medicine and engineering.

It did not seem that a great deal more could be done in the schools to increase the number of physics students, but the quality of the teaching might well be improved considerably.

MR. H. JEFFERSON said that since the war he had spent six years out of this country. Looking at the problem from the outside, it seemed that very simple arithmetic could be applied to it. In *The Times* two days ago the statement was made that run-of-the-mill physicists in industry might expect to get £1,200 a year at the age of 40. In Sweden, run-of-the-mill physicists in industry at the age of 40 would be getting about 50 per cent more, and the workers at the bench would be getting more. The school leavers received about the same as graduates in this country. Yet, in the markets in which the company with which he had been working were operating, they had been able to compete with British firms and to sell things which were cheaper, and he thought, quite as good. In this country a physicist could not buy as much as he could before the war for the same amount of work.

The background of the shortage of scientists was purely economic. If more physicists were wanted it was necessary to buy them in what was actually a world market. The physicist was one of the few people who could move about ; he could go somewhere else and sell his goods, and people in this country who wanted physicists had to compete with the European countries which were paying more, with the Canadians and Americans, and probably with the Australians too.

MR. F. W. HAYWARD (*Reed Paper Group*) said that his Group had found great difficulty in recruiting graduates at all levels of experience. For this and other reasons they had decided that Sir Owen's Category C, the school-leavers who have some knowledge of and liking for science and wish to make a career of it, were a very important source of scientific and technical staff. These people must not only be given a scientific job but also be given opportunities in time off to complete their training. To release staff for one day a week for further education usually meant carrying extra staff, but it was a well worth while investment.

When recruiting staff of this category they were advised not to take a degree by part time study, a very hard job which often leads to failure and frustration. The Reed Group Policy was to encourage study for National Certificates which could lead, for example, to Associateship of the Institute of Physics, equivalent to a degree. This could be done in stages at each of which the person concerned had some definite qualification. On the other hand, a "failed" degree man had often reached quite a high level of training and could not show any tangible evidence of it.

MR. HUMPHREYS said there was a good deal of substance in what the last speaker had said. His own laboratories had traditionally always trained a large proportion of their graduates ; of those who had graduated this year as the result of part-time courses 42 per cent obtained second-class honours, a record of which his Company were

proud. They also trained many people for the Higher National Certificate and other qualifications, but they had at the moment 90 students at Wembley and Stanmore studying for degrees. That number was a little larger than it should be, but he thought they could maintain it at about 50 and with very satisfactory results. The policy to-day was to set a very high standard for students at the time of recruitment.

DR. A. BLOCH (*The General Electric Co. Ltd.*) emphasized the importance, so long as the supply of physicists remained as at present, of making the best use of the personnel available and trying to upgrade them as much as possible. Postgraduate courses were a help but home study with the aid of good books was effective and time-saving. He drew attention, therefore, to the fact that, in contrast to post-war Germany, the cost of books was not admitted as a deduction from income tax.

DR. M. R. GAVIN (*Birmingham College of Technology*) as a former colleague of Mr. Humphreys who was now in the educational world, took up the point which Mr. Humphreys had made about the period of study of the student assistant being as much a period of training in industry as it was a period in the college. There could be a much better division of the time between the college and industry ; the solution was a sandwich scheme, with equal time in industry and in a teaching establishment. That had the advantage of making much better use of people in the Category C which had been mentioned, and it would help to improve the utilization of the available physicists. It would also satisfy the point which Mr. Humphreys had made about giving graduates a period of training after they came into industry ; they would have it concurrently with their study, and there was a great deal to be said for that.

For that type of person the degree was the wrong qualification. It was taken externally, and the teachers must continually have in mind what the student was going to be subjected to by someone else. If these courses were taken in major colleges, where the standards were undoubtedly high, the qualification should be not an external degree but a qualification awarded by that college. He was of opinion that such qualifications would obtain full recognition from the professional institutions.

MR. HUMPHREYS said that he was satisfied about the merit of the sandwich course for the training of engineers, but he remained to be convinced that it was right for physicists or for other scientists. This was a subject which he was now studying.

DR. H. R. LANG (*The Institute of Physics*) said that a bad aspect of the present shortage was the " body snatching " to which it led.

The effect on the young men in the universities of having a queue of people offering jobs and competing with one another, was regrettable. Some young graduates were starting at salaries of as much as £750 ; and that might be the answer to the shortage. If the salaries of physicists were raised, a great many more boys and girls might decide to study physics, and science generally. It might be that scientists had put their price far too low.

What was going to be done about the problem ? There was a Ministry of Labour Advisory Committee on Physicists, on which the President and he served, but it had not met for two or three years. If more boys and girls went in for science now, they would become of value in seven to ten years time, and no one knew what would happen then. It was to be hoped that by that time the defence programme would no longer be on such an enormous and rapdily-developing scale as it was to-day. Were there going to be enough jobs for these boys and girls in that case ? We ought not to encourage too many people to go in for a scientific career if half the jobs—and he believed that half the jobs at present were related, directly or indirectly, to the defence programme—were going to disappear. If they could feel that when defence projects fell off, scientists would be diverted to other useful research and development there would be no need to feel so unhappy about it.

MR. HUMPHREYS said that he would like to see the supply of physicists more closely related to the demand so that the competition for their services might become less severe and the initiative in seeking employment might return to the physicists themselves.

No one could see seven to ten years ahead. It was usually found that when one demand fell off or disappeared something else which was new or which had been suppressed arose and took its place. The money which was being spent at the moment on defence research was contributing nothing positive to man's well-being. If that same effort could be diverted to projects designed to raise the standard of living all would benefit.

REPORTS OF INSTITUTE MEETINGS

Yorkshire Branch

A meeting of the Yorkshire Branch of The Institute of Physics was held on Wednesday, February 16, 1955, in the Physics Department of the University of Leeds at 3 p.m. The Speaker was Sir John Cockcroft, K.C.B., C.B.E., F.R.S., F.Inst.P., President of The Institute, who gave a lecture entitled " Portrait of a Research Establishment " in which he described the industrial programme of the Atomic Energy Establishment and outlined the possible applications of nuclear energy. About 60 members and over 100 non-members were present. Before the meeting Sir John had lunch with some 20 members of the Branch at University House.

Education Group

The annual conference of the Education Group of the Institute was held at the Institute's House on April 14 and 15, about 80 people attending. This was considered to be one of the most successful conferences that the Group has held. All the papers read are to be published in later issues of the *Bulletin*.

LIVERPOOL AND NORTH WALES BRANCH

Inaugural Meeting

The inaugural meeting of the newly-formed Liverpool and North Wales Branch of the Institute will be held in the Physics Department of the University of Liverpool at 7 p.m. on Thursday May 19. After a short business meeting a lecture will be given by Professor Z. Kopal, Professor of Astronomy in the University of Manchester; his subject is " Physics of the Sun." The meeting is open to all interested. Tea will be served at 6.15 p.m. and those who hope to arrive in time for tea are asked to notify Dr. J. D. Craggs. The provisional committee of the Branch have nominated Professor E. A. Owen, Emeritus Professor of Physics in the University College of North Wales, Bangor, as the first Chairman of the Branch, and Dr. J. D. Craggs, Reader in Electronic Engineering, University of Liverpool, as the first Honorary Secretary.

College of Technology, Birmingham
Department of Physics and Mathematics

There is a vacancy for a **Research Assistant** in the Department of Physics and Mathematics for taking part in a major electronic project. Candidates should have a good honours degree, preferably of London University or of a university which awards higher degrees for external research. Experience in the design of electronic circuits is essential. The successful candidate will be expected to do some teaching, but ample time will be available for research.

Salary will be in accordance with the Burnham (Further Education) Scale for Grade "A" Assistants. Basic salary (Men) £510 with increments for approved training and industrial or teaching experience.

Further particulars and form of application may be obtained from the Registrar, College of Technology, Suffolk Street, Birmingham 1, on receipt of a stamped addressed foolscap envelope. Completed forms should be returned not later than two weeks after the appearance of this advertisement.

K. R. Pilling,
Clerk to the Governing Body.

Nelson Research Laboratories
English Electric Co., Ltd.,
Stafford,
have a vacancy for a **Physicist** having an interest in solid state physics and electronics, to work on the fundamental properties and applications of materials suitable for use in electronic storage devices.
An honours degree and some research experience are desirable.
Salary at present day levels in accordance with age and qualifications. Please reply to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 1353B.

The United Kingdom Atomic Energy Authority, Aldermaston, Berks., requires a **Senior Scientific Officer** or **Scientific Officer** to carry out research on fundamental problems connected with the design of ultra high speed rotating systems. Minimum qualifications are first or second class honours degree in physics or engineering with research experience in some problems involving a theoretical approach to engineering. Candidates are also required to have a reasonable knowledge of workshop practice. Experience in any aspect of high-speed rotor work would be an advantage. For the Senior Scientific Officer grade some year appropriate postgraduate research experience is essential. The salary ranges are :—Senior Scientific Officer £1,040 – £1,205 per annum (male) and Scientific Officer £505 – £905 per annum (male). The starting salary for Scientific Officer is assessed according to age, qualifications and experience. The successful applicant will be required to join the Authority's Principal Superannuation Scheme and contribute 6% of salary. Housing will be available within a reasonable period for married officers who live outside the radius of the Establishment's transport facilities. During this period, lodging allowance may be payable to suitably qualified candidates. Application form from Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote Ref. 322/WGE/110.

Manchester Municipal College of Technology
(Faculty of Technology in the University of Manchester).
Appointment of
Assistant Lecturer in Physics

The Governing Body invites applications for an Assistant Lectureship in Physics in the College of Technology, with the title and status of Assistant Lecturer in the University of Manchester.

The Physics Department prepares students for the degree of B.Sc.Tech. in Applied Physics, provides classes for students in the Engineering and Chemistry Departments in the Faculty and conducts classes in Physics for part-time students of a number of the Departments in the College. The Assistant Lecturer will be expected to take part in this teaching, but he will also be allowed ample time for research : the research activities of the department are at present mainly concerned with X-ray diffraction, but it is hoped shortly to extend the work to the field of solid-state physics.

The Department is shortly to move into new and enlarged quarters in the College extension.

Salary : £550 per annum, rising by annual increments of £30 to £650. Superannuation under F.S.S.U. and family allowances.

Conditions of appointment and form of application may be obtained from the Registrar, College of Technology, Manchester 1. The last day for the receipt of application is 23rd May, 1955.

B. V. Bowden,
Principal of the College.

College of Technology, Birmingham.
Department of Physics and Mathematics.
Applications are invited for the post of **Senior Lecturer in Electronics.**

Candidates must have high academic qualifications and some research experience, preferably in industry. Teaching experience is desirable but not essential. The successful candidate will be expected to take part in the extensive research programme already in operation.

Salary will be in accordance with the Burnham (Further Education) Scale for Senior Lecturers (Men : £1,065 × £25 – £1,215).

Appointment to date from 1st September, 1955.

Further particulars and form of application may be obtained from the Registrar, College of Technology, Suffolk Street, Birmingham 1, and completed forms should be returned to him not later than two weeks after the appearance of this advertisement.

K. R. Pilling,
Clerk to the Governing Body.

Monsanto Chemicals Limited invite applications for a post in research at Ruabon on instrument development work. Candidates should preferably be 23–28 years of age with an honours degree or equivalent in physics or electrical engineering. A knowledge of chemistry up to Higher National or pass degree standard would be an added advantage although not essential. The post, which offers good scope and prospects, is permanent and pensionable and is concerned with the development of new instruments both for physical and chemical research and for chemical production usage. A salary fully commensurate with experience and qualifications is offered. Details in writing of age, educations training and experience should be sent to the Chief Personnel Officer, Monsanto Chemical, Limited, 8 Waterloo Place, London, S.W.1.

(*Continued on page vi*)

The United Kingdom Atomic Energy Authority, Aldermaston, Berks., requires **Experimental Officers** and **Assistant Experimental Officers** to carry out the following duties :—

Post 1—612/WGE/110. To assist in a wide variety of experimental nuclear physics including work associated with a 6 Mev Van de Graaff and other Particle Accelerators being installed shortly. Previous experience in nuclear physics experimental work or electronics would be advantageous.

Post 2—613/WGE/110. To assist in work on radio-active decay schemes and absolute measurements. Some experience in electronics is essential and familiarity with nuclear radiation detection and/or high vacuum work would be an advantage.

The minimum qualification is Higher School Certificate (Science) or equivalent, but for Experimental Officer posts a pass degree in Physics is desirable.

Salary : Experimental Officer (minimum age 26) £775 – £945 p.a. (male) ; Assistant Experimental Officer £310 (age 18) to £685 p.a. (male). Superannuation : The successful applicants will be required to join the Authority's Contributory Scheme.

Housing : Housing accommodation will be available within a reasonable period for married officers who live outside the radius of the Establishment's transport facilities, or, alternatively, the Authority may be able to assist successful candidates in the purchase of a house. During this period a lodging allowance may be payable.

Requests for application forms by Postcard to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quoting appropriate reference.

W. Edwards & Co. (London) Limited, High Vacuum Engineers, Manor Royal, Crawley, Sussex, have the following vacancies in their Research Laboratory :—

Vacuum Physicist (Qualified Physicist or equivalent) required for research and development of instruments and apparatus, including optical, mechanical and ionization devices. Previous high vacuum experience a distinct advantage.

Physicist or **Chemical Engineer** (Graduate or equivalent) required for research and development on vacuum drying and allied problems. Must have laboratory experience preferably in vacuum or refrigerating fields.

Research Assistant (Graduate or equivalent) in vacuum deposition section. Work ranges from investigations into the properties and uses of vacuum evaporation and cathodic, sputtered films, to development of new High Vacuum plant.

Low Temperature Research Assistant (Degree or equivalent in Engineering or Physics) for apparatus development. Experience in vacuum and/or handling of liquefied gases an advantage. Development aptitude and associated skills essential.

Commencing salaries offered are commensurate with age, qualifications, and experience and range from £600 to £750 per annum. Housing available if from London area. Pensionable position. Write giving full details to the Personnel Officer.

E.M.I. Engineering Development Ltd.
Senior Engineer/Physicist

An attractive vacancy exists at this Company's Feltham laboratories for a **Senior Engineer/Physicist** to work on a number of theoretical problems in the G.W. field. The man we are looking for will be qualified and will have had some related experience. His main responsibility will be of devise series of critical laboratory and field experiments in connection with weapon developments. An attractive salary will be offered to the successful applicant for this pensionable post, and the prospects in this active and expanding Company are excellent. Please send your first reply to Personnel Department (ED/238), E.M.I. Engineering Development Limited, Blyth Road, Hayes, Middlesex.

Woolwich Polytechnic, London, S.E.18
Principal :
J. S. Tait, Ph.D., B.Sc., A.R.T.C., M.I.E.E., A.M.I.Mech.E.

Applications are invited from honours graduates and from students entering for their Final Honours (Special) degree examination in June next for **Research Assistantships** in Physics. The assistantship will normally lead to the Ph.D. degree (Internal) of the University of London. Its value is £350 p.a. and is tenable for two to three years.

Particulars and application form from Clerk to Governors.

Woolwich Polytechnic, London, S.E.18
Principal :
J. S. Tait, Ph.D., B.Sc., A.R.T.C., M.I.E.E., A.M.I.Mech.E.

Applications invited for the following :—

Lecturer in Physics from candidates with an honours degree. Burnham Further Education salary scales. Particulars and application form from Clerk to Governors, to be returned as soon as possible.

Physicist. Tootal Broadhurst Lee Company Ltd., have a vacancy in their Research Department for a young Honours graduate or Ph.D. in physics. The appointment involves research in connection with all textile fibres and gives an opportunity for initiative and independent work. Knowledge of textiles is desirable but by no means essential. Initial salary according to qualifications and experience ; pension and profit sharing schemes apply. Applications to the Personnel Manager, 56 Oxford Street, Manchester, 1.

Standard Telephones and Cables Limited, the pioneers in semi-conductor development, have a number of vacancies for graduate physicists to assist in a rapidly expanding development programme. An interest or experience in electronics would be an advantage. Applications stating qualifications and giving fullest details of career and experience should be sent to the Personnel Manager at Dowlish Ford Mills, Ilminster, Somerset.

(*Continued on page vii*)

The United Kingdom Atomic Energy Authority, Aldermaston, Berks, requires **Physical Chemists** in the grade of **Experimental Officers** or **Assistant Experimental Officers,** to assist in groups engaged in (*a*) the production of experimental high explosive charges, or (*b*) the production and filling of initiatory explosives, and to undertake development work in these fields. The minimum qualification is Higher School Certificate (Science) or equivalent although for Experimental Officer a pass degree is desirable. For post (*a*) experience of plant work would be an advantage.

Salary : Experimental Officer £775 (minimum age 26) – £945 p.a. (Male) ; Assistant Experimental Officer £310 (age 18) – £685 p.a. (Male).

The successful applicants will be required to join the Authority's contributory Superannuation Scheme.

Housing accommodation will be available within a reasonable period for married officers who live outside the radius of the Establishment's transport facilities or alternatively the Authority may be able to assist successful candidates in the purchase of a house. During this period a lodging allowance may be payable.

Requests for application forms by post card to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote reference 633/WGE/110.

The United Kingdom Atomic Energy Authority, Aldermaston, Berks, requires **Experimental Officers** and **Assistant Experimental Officers** for the design and applications of pneumatic control systems mainly for the measurement of temperature and humidity. The minimum qualification is Higher School Certificate (Science) or equivalent but for Experimental Officer posts a pass degree is desirable. Experience in the design and operation of such systems would be an advantage.

Salary : Experimental Officer £775 – £945 p.a. (Male) (minimum age 26) ; Assistant Experimental Officer £310 (age 18) £685 p.a. (Male).

Successful candidates will be required to join the Authority's Contributory Superannuation Scheme.

Housing accommodation will be available within a reasonable period for married staff who live outside the Establishment's transport facilities or alternatively the Authority may be able to assist successful candidates in the purchase of a house. During this period a lodging allowance may be payable. Send post card for application form to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote reference 627/WGE/110.

Royal Technical College, Salford

Appointment of Assistant Lecturer in Physics

Applications are invited for the post of Assistant Lecturer, Grade B, in the Department of Physics. Candidates should preferably have had some teaching, industrial and/or research experience. Duties will include teaching to Intermediate and General B.Sc. standard. The salary will be in accordance with the Burnham Technical Scale.

£525 – £820 with allowances (men)
£475 – £655 with allowances (women)

Forms of application and further particulars may be obtained from The Principal, Royal Technical College, Salford 5.

R. Ribblesdale Thornton,
Clerk to the Governors.

The United Kingdom Atomic Energy Authority, Aldermaston, Berks, requires **Physicists, Physical Chemist,** or **Mathematicians** in the grade of Experimental Officer or Assistant Experimental Officer for the following duties :

(*a*) Physicist or Physical Chemist to assist in the measurement of power and sensitiveness of explosives ;

(*b*) Physicist to assist in research work of a spectroscopic group ;

(*c*) Physicist or Mathematician to carry out computation work in the evaluation of explosive properties of new explosives and to assist in the measurement of these properties.

The minimum qualification for these posts is Higher School Certificate (science) or equivalent but for Experimental Officer posts a pass degree is desirable. For post (*a*) a knowledge of elementary statistics is desirable ; for post (*b*) some experience of emission or absorption spectroscopy would be an advantage.

Salary : Experimental Officer £775 (minimum age 26) – £945 p.a. (Male) ; Assistant Experimental Officer £310 (age 18) – £685 p.a. (Male).

The successful applicants will be required to join the Authority's Contributory Superannuation Scheme.

Housing accommodation will be available within a reasonable period for married officers who live outside the radius of the Establishment's transport facilities or alternatively the Authority may be able to assist successful candidates in the purchase of a house. During this period a lodging allowance may be payable.

Requests for application forms by post card to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote reference 632/WGE/110.

College of Technology, Birmingham
Department of Electrical Engineering

Applications are invited for the post of **Lecturer.** Applicants should have practical experience in either the Heavy Power side of Electrical Engineering or the Light Current side, and should possess an Honours Degree in Electrical Engineering or its equivalent.

Salary will be in accordance with the Burnham (Further Education) Scale for Lecturers (Men) £965 × £25 – £1,065 ; (Women) (under review) £772 × £20 – £852 + equal pay increment.

The person appointed will be required to take up duty on the 1st September, 1955, or as early thereafter as possible.

Further particulars and form of application may be obtained from the Registrar, College of Technology, Suffolk Street, Birmingham, 1, on receipt of stamped addressed foolscap envelope. Completed forms should be returned to him not later than 2 weeks after the appearance of this advertisement.

K. R. Pilling,
Clerk to the Governing Body.

Physicist or **Physical Chemist** required by the **British Cast Concrete Federation** to undertake research into the physical structure and properties of concrete at research laboratories of the Cement and Concrete Association, Wexham Springs, near Slough. Applicants should have an honours degree and should preferably be under 26 years of age, but if older, should have had experience in allied fields and a commensurately higher salary will be considered. Applications giving full details, including age, experience and ability, also commencing salary expected, should be addressed in writing to Secretary, B.C.C.F., 105 Uxbridge Road, Ealing, W.5.

(*Continued on page viii*)

Commonwealth of Australia

Appointment No. 750/108 of **Senior Research Officer** or **Research Officer**—Three Year Appointment.

The Commonwealth Scientific and Industrial Research Organization invites applications for appointment to a position of **Senior Research Officer** or **Research Officer,** Division of Metrology, National Standards Laboratory, Sydney, N.S.W.

Initially the appointment will be made for a period of three years, but may be extended. First class sea fares for the successful applicant and his wife and family will be paid and also return fares in the cases where the appointee does not take up a permanent position in C.S.I.R.O., at the expiry of his fixed period. The appointment is subject to a satisfactory medical examination.

Duties : The appointee will be responsible for research and development in the field of experimental stress and strain analysis, particularly wire resistance strain gauging and photoelasticity. Within certain limits he will be free to initiate research projects, but will be required to co-operate in the solution of static and dynamic strain problems arising from the current research in metal cutting and vibration. A considerable amount of equipment is already available for wire resistance strain gauge and photoelasticity work and facilities will be extended as warranted.

Qualifications : University honours degree in engineering, or in science, with physics as a major subject, or equivalent qualifications, together with some years post-graduate experience in the appropriate field. Evidence of research ability is essential.

Salary : Depending on qualifications and experience, commencing salary will be determined within the range of Senior Research Officer £A1814 – £A2078 p.a. or Research Officer, £A1184 – £A1730 p.a.

Applications, referring to Appointment No. 750/108, and stating full name, place, date and year of birth, marital state, nationality, present employment, particulars of qualifications and experience, and of war service, if any, accompanied by the names and address of two persons willing to act as referees and by copies of not more than four testimonials, should reach the undersigned not later than the 18th June, 1955.

W. Ives,
Chief Scientific Liaison Officer.
Australian Scientific Liaison Office,
Africa House, Kingsway,
London, W.C.2.

The British Iron and Steel Research Association : Operational Research. Applications are invited for the post of Head of one of the pioneer industrial operational research units in the country. Duties will include the supervision and control of about a dozen graduates who are working on a variety of problems in connection with planning, management and organization in the Iron and Steel Industry. Candidates should have a degree in Science, Economics, Engineering or Mathematics. The salary range is from £1080 to £1520 p.a., according to age, qualifications and experience, and the post is superannuated under the F.S.S.U. Those interested are invited to write personally to Sir Charles Goodeve, BISRA, 11 Park Lane, London, W.1, asking about the job and telling him about themselves.

Hivac Limited, a Company associated with a major group in the Telecommunications Field, invites applications for vacancies which have arisen in connection with a new Project in the Semiconductor Field from the following :

Physicists

Electronic Engineers

Physical Chemist/Metallurgist

The work will cover a wide range of problems concerned with basic properties of materials and their relationship to device behaviour, with application and extension of device theory and with the development and assessment of methods of measurement and process control. It will thus offer considerable scope for originality.

Candidates should possess a good academic education combined with enough research training to enable them to assume responsibility for the solution of specific problems with a minimum of supervision.

The Company's activities are expanding and the posts, which are pensionable, offer scope for advancement.

Applications, which will be treated in strict confidence, quoting reference " NP " and stating age, education, qualifications and salary expected, should be addressed to The Engineer-in-Chief, Hivac Limited, Greenhill Crescent, Harrow-on-the-Hill, Middlesex.

Mathematician required in connection with research and development of Scientific Instruments of wide variety. Applicants must have mathematics on the level of a good honours degree, and also some knowledge of physics.

Applications, stating age and qualifications, should be addressed to The Secretary, **Messrs. Barr and Stroud Limited,** Anniesland, Glasgow, W.3, under reference 724/T-15.

Design Engineers and **Technical Sales Engineers** required for work on special apparatus such as Electron Linear Accelerators, Mass Spectrometers, High Vacuum Equipment, etc. These posts would be of considerable interest to engineers or physicists with good degrees and some postgraduate experience. Salary in accordance with experience and qualifications. Write for application form to : The Personnel Manager, **Metropolitan-Vickers Electrical Company Ltd.,** Trafford Park, Manchester 17. Mark envelope "Y.1."

MEMBERS' ADVERTISEMENT

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